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WOLF GREENFIELD & SACKS, P.C.
600 ATLANTIC AVENUE
BOSTON, MA 02210-2206

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/525,496	IMOTO ET AL.	
	Examiner	Art Unit	
	THANH-TRUC TRINH	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 February 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-7,9,10 and 25-28* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-7, 9,10 and 25-28* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-7, 9-10 and 25-28 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

As amended, claim 1 recites the limitation "wherein the semiconductor layer comprises a plurality of different energy levels through which the charge carrier is transferred, a first semiconductor region having, on a side to which the photosensitizing dye is adhered, an irregular contour that includes a concave portion and a convex portion; and a second semiconductor region that is joined to the irregular contour of the first semiconductor region, wherein the plurality of different energy levels in the semiconductor layer are reduced stepwise or continuously in a direction of drawing the charge carrier out" in lines 5-15. There is no support found in the originally filed disclosure for a semiconductor layer comprising a combination of "a first semiconductor region having, on a side to which the photosensitizing dye is adhered, an irregular contour that includes a concave portion and a convex portion; and a second semiconductor region that is joined to the irregular contour of the first semiconductor

region" and "the plurality of different energy levels in the semiconductor layer are reduced stepwise in a direction of drawing the charge carrier out". The former limitation is directed toward embodiments 3 and 4 (see Figures 4A-5B and embodiments 3 and 4 of Applicant's disclosure), in which the plurality of different energy levels are formed by ion implantation of dopant and followed by annealing to create a gradient of concentration of dopant (or diffusion layer 43). There is in no way a gradient of concentration in such embodiment is a plurality of different energy levels being reduced stepwise. There is nothing in Applicant's specification indicating that such combination could be reasonably conveyed to the artisan that the inventor had possession at the time of the invention was made.

Claim 2 depends on claim 1 and recites the limitation "the plurality of different energy levels comprise a plurality of semiconductor films within the semiconductor layer" in lines 2-4, while claim 1 is directed toward embodiments 3 and 4 (e.g. with concave and convex portions), in which the plurality of different energy levels comprise only one semiconductor film (e.g. diffusion layer 43). There is nothing in Applicant's specification would reasonably convey to the artisan that the inventor had possession at the time of the invention was made.

Claim 3 depends on claim 1 and recites the limitation "wherein the plurality of different energy levels comprise a plurality of semiconductor materials in which constitutional elements are different from one another" in lines 2-3, while claim 1 is directed toward embodiments 3 and 4 of Applicant's disclosure, in which the plurality of different energy levels are created by doping the same semiconductor material (e.g.

TiO_2) with a concentration gradient of dopant (see embodiments 3 and 4 of Applicant's disclosure). There is no description of the combination of semiconductor regions with concave and convex portions and having a plurality of different energy levels comprises a plurality of semiconductor materials in which constitutional elements are different from one another. There is nothing in Applicant's specification indicating that such combination could be reasonably conveyed to the artisan that the inventor had possession at the time of the invention was made

Claim 4 depends on claim 1 and recites the limitation "wherein the plurality of different energy levels comprise semiconductor materials comprising same constitutional elements with one another and ratios of the constitutional elements differ for each energy levels" in lines 2-4. There is no support for a semiconductor layer comprising a combination of semiconductor regions having concave and convex portions and the plurality of different energy levels comprising semiconductor of same constitutional elements with one another and ratios of the constitutional elements differ for each energy levels. The semiconductor regions having concave and convex portions are directed toward embodiments 3 and 4, in which the semiconductor is of the same element (e.g. TiO_2). There is nothing in embodiments 3 or 4 indicating the ratios of the constitutional elements differ for each energy levels. More specifically, there is no description in Applicant's specification indicating that such combination could be reasonably conveyed to the artisan that the inventor had possession at the time the invention was made.

Claim 5 depends on claim 1 and recites the limitation "wherein the plurality of different energy levels comprise semiconductor materials which are of a same element composition and are of different dopants from one another" in lines 2-3. There is no support for a semiconductor layer comprising a combination of semiconductor regions having concave and convex portions and the plurality of different energy levels comprising semiconductor materials which are of the same element composition and are of different dopants from one another. The semiconductor regions having concave and convex portions are directed toward embodiments 3 and 4, in which the semiconductor is of the same element (e.g. TiO_2) and the dopant (or combination of dopants) is diffused through a bulk TiO_2. There is no description in embodiments 3 or 4 indicating the plurality of different energy levels are of different dopants from one another. More specifically, there is nothing in Applicant's specification indicating that such combination could be reasonably conveyed to the artisan that the inventor had possession at the time the invention was made.

Claim 7 depends on claim 1 and recites the limitation "wherein the photosensitizer dye is adhered on a surface of the semiconductor layer or impregnated inside the semiconductor layer" in lines 2-3. Claim 1 is directed toward the embodiments 3 and 4 of Applicant's disclosure, in which the photosensitizing dye is adhered on a surface of the semiconductor layer (see embodiments 3 and 4 in Applicant's specification). There is nothing in embodiments 3 and 4 describing impregnating the photosensitizing dye inside the semiconductor layer. There is also no description of combination of the limitation as claimed in claim 1 and the photosensitizing dye is

impregnated inside the semiconductor layer so that it would reasonably convey one skilled in the art that inventor had possession at the time the invention was made.

Claim 25 depends on claim 1 and recites the limitation “the first semiconductor region comprises a patterned film implanted with ions" in line 2-3, while claim 1 recites "a first semiconductor region having, on a side to which the photosensitizing dye is adhered, an irregular contour that includes a concave portion and a convex portion" in lines 9-10. There is no support for the first semiconductor region comprises a combination of patterned film implanted with ions and having a photosensitizing dye adhered on a side. In embodiments 3 and 4 disclosed by Applicant, the photosensitizing dye is adsorbed on the TiO_2 fine grain 47 and the semiconductor region comprises a patterned film implanted with ions is TiO_2 film 41 which is diffusion region 43 after the ions implantation (see Figures 4A-4G, and step 7 of embodiment 3 of Applicant's disclosure). There is no description in Applicant's specification indicating that one out of two semiconductor regions in a semiconductor layer comprises both a side for photosensitizing dye adhered on and a patterned film implanted with ions.

Claim 26 depends on claim 1 and recites the limitation "wherein the first semiconductor region comprises an impurity diffusion layer" in lines 2-3, while claim 1 recites "a first semiconductor region having, on a side to which the photosensitizing dye is adhered, an irregular contour that includes a concave portion and a convex portion" in lines 9-10. There is no support for the first semiconductor region comprises a combination of patterned film implanted with ions and having a photosensitizing dye adhered on a side. In embodiments 3 and 4 disclosed by Applicant, the photosensitizing

dye is adsorbed on the TiO_2 fine grain 47 and the semiconductor region comprises a patterned film implanted with ions is TiO_2 film 41 which is diffusion region 43 after the ions implantation (see Figures 4A-4G, and step 7 of embodiment 3 of Applicant's disclosure). There is no description in Applicant's specification indicating that one out of two semiconductor regions in a semiconductor layer comprises both a side for photosensitizing dye adhered thereon and an impurity diffusion layer.

Claims 2-7, 9-10 and 25-28 are rejected on the same ground as claim 1.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

4. Claims 1-3, 7, 10, and 25-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Koyanagi et al. (WO 99/63614 which is published December 9th, 1999 and has an English equivalence US Patent 6538194 to be relied upon below)

Regarding claims 1-3, 7 and 10, as seen in Figures 7-8, Koyanagi et al. teaches a dye-sensitized photoelectric conversion apparatus comprising a semiconductor layer (e.g. including layers 11, 12 and protrusions 14, see col. 11 line 30 through col. 16 line 56) comprising a photosensitizing dye (see photosensitizer, col. 16 lines 17-19, col. 10 lines 6-57), wherein a charge carrier generated by allowing light to be incident in the

photosensitizing dye can be drawn out through the semiconductor layer (see col. 1 lines 43-59). The semiconductor layer comprises:

- a plurality of different energy levels (e.g. metal oxide layer 12 such as titanium oxide as see col. 13 line 63 through col. 14 line 27, conducting layer of 11 and 14 of tin oxide as seen in col. 12 lines 10-45) through which the charge carrier is transferred, wherein the plurality of different energy levels comprises a plurality of semiconductor films within the semiconductor layer (e.g. TiO_2 and SnO_2 layers have different energy levels);
- a first semiconductor region having (see metal oxide layer 12 made of preferably TiO_2), on a side to which the photosensitizing dye is adhered (e.g. the side facing counter electrode as the photosensitizing dye is adsorbed onto the metal oxide layer), and irregular contour that includes a concave portion (see gaps between protrusions 14) and a convex portion (see protrusions 14); and
- a second semiconductor region (e.g. combination of protrusions 14 and layer 11 as 14 is formed of the same material as 11, see col. 12 lines 10-47) that is joined to the irregular contour of the first semiconductor region, wherein the plurality of different energy levels in the semiconductor layer are reduced stepwise in a direction of drawing the charge carrier out (e.g. it is noted that energy level of SnO_2 is smaller than TiO_2 according to Applicant's Figure 2).

Regarding claim 25, Koyanagi et al. further discloses the first semiconductor region (e.g. 12) comprises a patterned film implanted with ions (see Figures 7-8, col. 16 lines 11-15)

Regarding claim 26, Koyanagi et al. teaches implanting the first semiconductor region (e.g. metal oxide layer 12) with impurity (e.g. such as O_2, N_2, H_2, see col. 16 lines 11-15). Therefore the first semiconductor region inherently comprises an impurity diffusion layer.

Regarding claim 27, Koyanagi et al. further discloses the first semiconductor region (e.g. the metal oxide layer) comprising sintered semiconductor particles. (e.g. as the metal oxide layer of titanium particles are annealed, see col. 13 line 63 through col. 14 line 27, col. 16 lines 11-15, col. 1 lines 18-38)

Regarding claim 28, Koyanagi et al. further discloses the second semiconductor region (e.g. combination of layer 11 and protrusions 14) comprises a gap (e.g. between two protrusions 14) into which an electrolyte material (e.g. electrolyte 15) is deposited (see Figure 7).

5. Claims 1-3, 7, 10, and 25-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Chiba et al. (JP 2002-222971) as evidenced by Simmons (US Patent 5720827)

Regarding claims 1, 7 and 10, as seen in figure 1 and 4 of US 2002/0134426, Chiba et al. teaches a dye-sensitized photochemical cell conversion apparatus (e.g. dye

sensitized photovoltaic cell) comprising a semiconductor layer (e.g. porous photovoltaic layer 3 in Figure 1, layers 54 and 55 in Figure 4) comprising a photosensitizing dye (see paragraphs 0013-0014), wherein a charge carrier generated by allowing light to be incident in the photosensitizing dye can be drawn out through the semiconductor layer (see paragraph 0008, note that any functional dye sensitized solar cells would operate as such). Chiba et al. also teaches the semiconductor layer (3 in Figure 1, or 54 and 55 in Figure 4) comprises:

- a plurality of regions (e.g. 4 and 5 in Figure 1, 54 and 55 in Figure 4) having different energy levels from one another (e.g. as having different absorptions, see paragraph 0015, 0071-0073) so that the energy levels in the semiconductor layer are reduced stepwise in a direction of drawing the charge carrier out. (e.g. as going from absorbing short wavelength spectrum to absorbing long wavelength spectrum in the direction from light receiving surface to the electrode, see paragraphs 0015, 0023-0025, 0071-0073), wherein the charge carrier is transferred (e.g. as the electrons are transferred to the electrode, see paragraph 008) through a passage of the semiconductor (e.g. from layer 5 to layer 4 in semiconductor layer 3 in Figure 1, or from 54 to 55 in Figure 4). Note that the sensitivity wavelength region is corresponding to the energy levels such that the short wavelengths correspond to the high energy levels and the long wavelengths correspond to the low energy level. (see the summary of evidentiary reference to Simmons for this concept)

- a first semiconductor region (see 54 as seen in figure 4), on a side to which the photosensitizing dye is adhered (e.g. there is an irregular contour on either sides of layer 54 as seen in Figure 4, and photosensitizing dye is absorbed thereon and/or therein the porous photovoltaic semiconductor layers 54 and 55 as see paragraphs 0023 and 0071-0073; therefore the photosensitizing dye is adhered on a surface of the semiconductor layer or impregnated inside the semiconductor layer), an irregular contour that includes a concave portion (e.g. see caved in portions of layer 54 in Figure 4) and a convex portion (see protruding portions of layer 54 in Figure 4), and
- a second semiconductor region (see 55 in Figure 4) that is joined to the irregular contour of the first semiconductor region.

Regarding claim 2, Chiba et al. discloses the plurality of different energy levels (e.g. layers 4 and 5 as seen in Figure 1, 54 and 55 as seen in Figure 4) comprising a plurality of semiconductor films (e.g. layers 4 and 5 of semiconductor materials) semiconductor layer (3 in Figure 1, or 54 and 55 in Figure 4).

Regarding claim 3, Chiba et al. discloses the plurality of different energy levels (e.g. 4 and 5 in Figure 1, 54 and 55 in Figure 4) comprising a plurality of semiconductor materials (e.g. TiO_2 and ZnO, see examples 10 and 11) in which constitutional elements are different from one another.

Regarding claim 4, Chiba et al. discloses the plurality of different energy levels (e.g. 4 and 5 in Figure 1, 54 and 55 in Figure 4) comprising semiconductor materials

comprising same constitutional elements with one another and ratios of the constitutional elements differ for each energy level. (see examples 1-9, as both semiconductor materials in the first and second porous semiconductors such as 4 and 5 (or 54 and 55) are TiO_2 having different diameters, and the ratio of TiO_2 having a diameter used in the first porous semiconductor is changed stepwise such as from 100% in the first semiconductor to 10% in the second semiconductor as seen in example 1, or from 100% to 1% in example 3, etc...)

Regarding claim 9, Chiba et al. teaches the semiconductor layer (e.g. 3 in Figure 1) comprising the photosensitizing dye (see paragraph 0023), and an electrolyte layer (e.g. hole transporting layer 6 in Figure 1, 53 in Figure 4) are between a pair of electrodes (e.g. 10 and 20 in Figure 1, 56 and 52 in Figure 4). In regards to the limitation describing how to form the layers such as lamination, such limitation is a process limitation. The determination of patentability is based on the product itself, not on its method of production. If the product in the product-by-process is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). MPEP 2113.

Regarding claim 27, Chiba et al. teaches the first semiconductor region comprises sintered semiconductor particles. (see examples 1-9, as the semiconductor particles of Chiba et al. is baked at high temperature)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 5-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiba et al. (JP 2002-222971, see English language equivalent 2002/0134426) as

evidenced by Simmons (US Patent 5720827) as applied in claims 1-4, 7, 9-10 and 27 above, in view of Nakamura (JP 2002-008741)

Regarding claims 5-6, Chiba et al. teaches a dye sensitized photoelectric conversion apparatus as set forth, wherein the plurality of regions comprise semiconductor materials which are of a same element composition (e.g. TiO_2 as seen in examples 1-9)

Chiba et al. does not specifically teaches using different dopants in the semiconductor materials, and the concentration of the dopant is changed stepwise or continuously in the direction of drawing the charge carrier out.

Regarding claim 5, Nakamura teaches doping (e.g. adding to) the semiconductor materials (such as TiO_2, see paragraphs 0095-0105) with metallic element (e.g. second metallic element other than the semiconductor materials) such as alkali metal, aluminum, silicon, strontium, iron, colbalt, nickel, copper, zinc, tin, etc... (see paragraph 0005-0008). Therefore it would have been obvious to one skilled in the art at the time the invention was made to modify the apparatus of Chiba et al. by doping the semiconductor materials as taught by Nakamura, because such doping would control the conduction band energy level of semiconductor particle to provide a dye-sensitizing photoelectric conversion element being excellent in extraction voltage and having high conversion efficiency (see paragraphs 0007 and 0106). In addition, it would have been obvious to one having ordinary skill in the art to select different dopant for each semiconductor layer or different dopants for the semiconductor materials, because such

modification would involve nothing more than use of the known material for its intended use in a known environment to accomplish entirely expected results.

Regarding claim 6, Nakamura teaches doping a semiconductor layer of TiO_2 with second metallic compound (see paragraphs 0095-0097) and leaving the other semiconductor layer of TiO_2 (e.g. undercoat film) undoped (see paragraph 0097). Therefore, Nakamura teaches a plurality of regions (e.g. TiO_2 and undercoat film TiO_2) comprise materials in which a same dopant (e.g. second metallic compound) is doped in a semiconductor material (e.g. TiO_2) having a same element composition (e.g. TiO_2) and a concentration of the dopant is changed stepwise in the direction of drawing the charge carrier out. (e.g. from having the second metallic compound to not having the second metallic compound). It would have been obvious to one skilled in the art at the time the invention was made to modify the apparatus of Chiba et al. by having a plurality of regions comprising materials in which a same dopant is doped in a semiconductor material having a same element composition and the concentration of the dopant is changed stepwise as taught by Nakamura, because Nakamura teaches such doping into the semiconductor would control the conduction band energy level of the semiconductor particle to provide higher efficiency device (see paragraphs 0007 and 106) and the undoped semiconductor layer (e.g. undercoat film) is used to prevent short circuit (see paragraph 0017).

10. Claims 25-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chiba et al. (JP 2002-222971, see English language equivalent 2002/0134426) as

evidenced by Simmons (US Patent 5720827) as applied in claims 1-4, 7, 9-10 and 27 above, in view of Wang et al. ("The photoelectrochemistry of transition metal-ion doped TiO_2 nanocrystalline electrodes and higher solar cell conversion efficiency based on Zn^{2+}-doped TiO_2 electrode")

Regarding claims 25-26, Chiba et al. teaches a dye-sensitized photoelectric conversion apparatus as set forth above, wherein the first semiconductor region comprises a patterned film (e.g. TiO_2 layer with concave and convex portion as seen in Figure 4, and examples 1-9)

Chiba et al. does not teach the first semiconductor region (e.g. layer 54 of TiO_2) implanted with ions, or comprises an impurity diffusion layer.

Wang et al. teaches doping TiO_2 semiconductor material in dye-sensitized solar cell with dopants such as metal ion (see abstract), wherein the metal ions enter the lattice of the TiO_2 (or forming a diffusion layer, see section 3.5.2 "The characteristic of p-n photoresponse conversion" to obtain a larger incident photon to conversion efficiency.

It would have been obvious to one skilled in the art at the time the invention was made to have implanted the first semiconductor region (e.g. TiO_2 material) of Chiba et al. by metal ions to form a diffusion layer in the first semiconductor region as taught by Wang et al., because Wang et al. teaches such implanting would obtain a higher conversion efficiency than pure TiO_2. (see abstract).

11. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chiba et al. (JP 2002-222971, see English language equivalent 2002/0134426) as evidenced

by Simmons (US Patent 5720827) as applied in claims 1-4, 7, 9-10 and 27 above, in view of Koyanagi et al. (US Patent 6538194).

Regarding claim 28, Chiba et al. teaches a dye-sensitized photoelectric conversion apparatus as set forth above; wherein the first semiconductor region (54 in figure 4) comprises concave and convex portions, and the second semiconductor (55 in figure 4) region is joined to the irregular contour of the first semiconductor region.

Chiba et al. does not teach the second semiconductor region comprising a gap into which an electrolyte material is deposited. In other words, the concave portions of Chiba et al. are not deep enough so that forming gaps into which an electrolyte material is deposited.

Koyanagi et al. teaches a dye-sensitized photoelectric conversion device comprising a first semiconductor region (e.g. layer 14 of TiO2) and second semiconductor region (e.g. including layer 11 and protrusions 14 of SnO2), wherein the second semiconductor region forms a gap (e.g. the gap between two adjacent protrusions) into which the electrolyte (e.g. 15) is deposited. (see Figures 7-8, col. 11 line 30 through col. 16 line 56). It would have been obvious to one skilled in the art at the time the invention was made to modify the device of Chiba et al. by having the second semiconductor region comprises a gap into which an electrolyte material is deposited as taught by Koyanagi et al., because Koyanagi et al. teaches such arrangement would increase the contact area between the electrolyte and the semiconductor material thereby increasing the quantity of light incident and

photosensitizer adsorption which in turn enhances the photoelectric transfer efficiency. (See col. 13 lines 32-41).

Response to Arguments

12. Applicant's arguments with respect to claims 1-7, 9-10 and 24-28 have been considered but are moot in view of the new ground(s) of rejection.

Applicant points to Figures 4E-5B and paragraphs [0089], [0090], [0098] and [0102] to show support for the amendment in the claims. However, Figures 4E-5B and cited paragraphs are directed toward embodiments 3 and 4 which have a plurality of different energy levels reduced continuously (as the semiconductor material is graded with a gradient of dopant concentration). There is nothing in embodiments 3 and 4 that would reasonably convey one skilled in the art that Applicant had a possession of the claimed plurality of different energy levels in the semiconductor layer reduced stepwise in the embodiments 3 and 4, or the combination of embodiments 1-2 and 3-4 in Applicant's disclosure, since each embodiment contains a unique way to reduce the energy levels in the semiconductor layer.

Applicant also points to paragraphs [0046], [0033] and [0062] for support of claims 2 and 4. However, the claimed limitations in claims 2 and 4 are directed toward embodiments 1 and 2, while claim 1 is directed toward embodiments 3 and 4. There is no description in Applicant's disclosure would reasonably convey one skilled in the art that inventor had a possession of the combination of disclosed embodiments at the time the invention was made.

Applicant argues that none of the references teaches the claimed limitations as amended in claim 1. However, the Examiner respectfully disagrees. Koyanagi et al. teaches a semiconductor layer (e.g. including metal oxide layer 12 and conducting layer of 11 and protrusions 14) comprising a plurality of different energy levels (e.g. since metal oxide layer 12 is preferred to be TiO_2, and conducting layer of 11 and 14 is SnO_2; wherein TiO_2 and SnO_2 have different energy levels through which the charge carrier is transferred; a first semiconductor region having (e.g. metal oxide layer 12), on a side to which the photosensitizing dye is adhered (e.g. since photosensitizer is absorbed on the metal oxide layer 12), an irregular contour that includes a concave portion and a convex portion (see Figures 7 and 8 of Koyanagi et al.); and a second semiconductor region (e.g. the conducting layer of 11 and 14) joined to the irregular of the first semiconductor region. (See the rejection above)

Similarly, Chiba et al. teaches a semiconductor layer (e.g. a layer including layers 54 and 55 in Figure 4) comprising a plurality of different energy levels (e.g. 54 and 55 semiconductor layers since each layer absorbed different wavelengths); a first semiconductor region (e.g. 54) having photosensitizing dye adsorbed on a side, a irregular contour of concave and convex portions (see figure 4, and paragraphs 0023, 0072) of Chiba et al.), and a second semiconductor region (e.g. 55) joined to the irregular contour of the first semiconductor region (see Figure 4, and the rejection above).

Conclusion

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to THANH-TRUC TRINH whose telephone number is (571)272-6594. The examiner can normally be reached on 8:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Basia Ridley can be reached on 571-272-1453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

TT
3/14/2010

/Basia Ridley/
Supervisory Patent Examiner, Art Unit 1795